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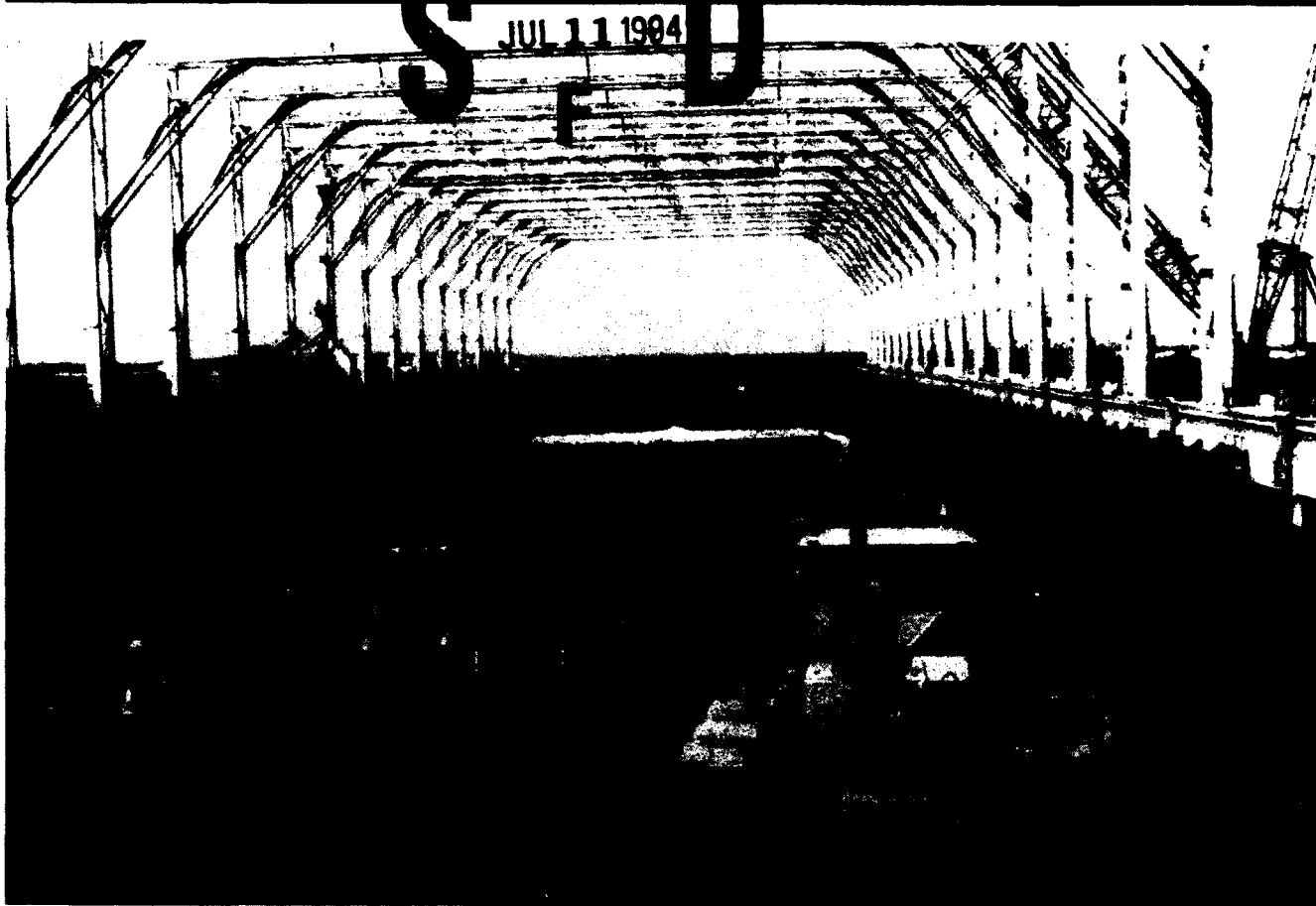


Dredging Research

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Fluidizing barge and dredge in operation

Innovative dredging/fluidization for protection of fiberglass tubes

by James E. Clausner and Thomas J. Wright

The U.S. Navy's Trident Submarine Base in Kings Bay, Georgia, has a new magnetic silencing facility. An integral part of this facility is a row of fiberglass tubes designed to house devices that measure and eliminate a submarine's mag-

netic signature. The fiberglass tubes are placed approximately 30 feet apart along a distance of 700 feet (Figure 1). During construction of the facility in 1991, the pipes were jetted deep into the bottom, with the top of the pipes at -44 feet mean low water



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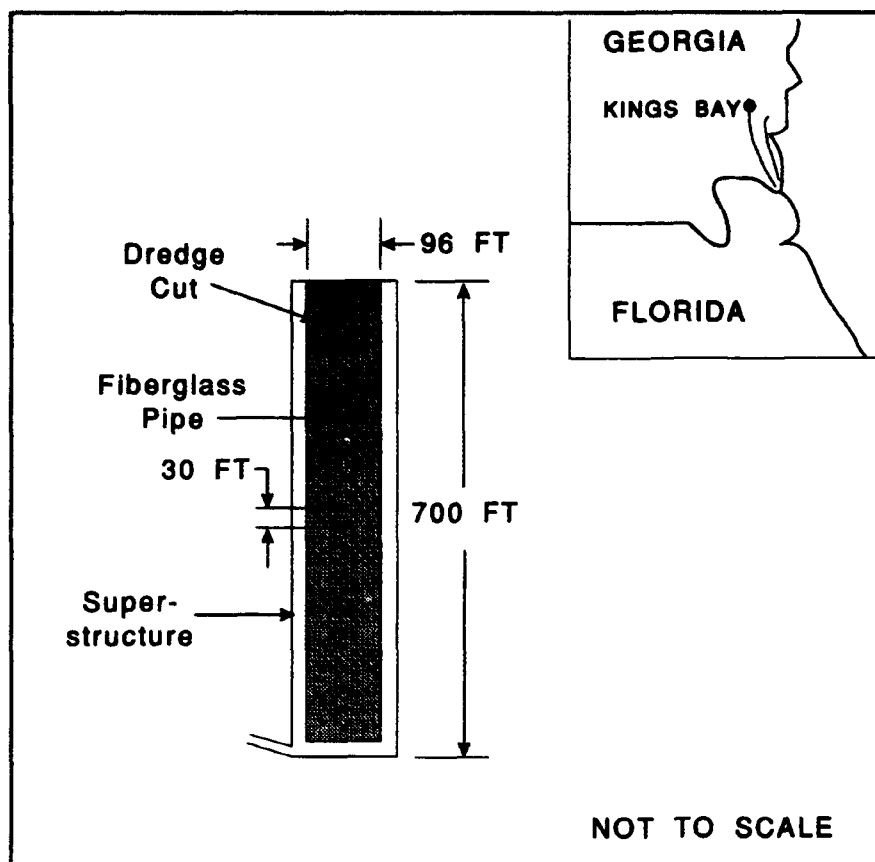


Figure 1. Project general location and layout

(mlw). Plugs were placed in the top of the tubes to keep out shoal material.

Between completion of the in-water portion of the facility in 1991 and August 1993, approximately 8 feet of silt deposited in the slip. This meant that, before the Navy could install the devices within the fiberglass tubes, the slip had to be dredged and the tubes uncovered without damage.

Under contract with the Corps' Savannah District, Wright Dredging Company of Chesapeake, Virginia, developed an innovative technique for dredging the slip without damaging the fiberglass tubes. The 10-inch cutterhead dredge *Long Bay*, owned by Marcol Dredging of Charleston, South Carolina, was specially modified for this project. The ladder was extended to 53 feet, and

a custom-designed auger head (though similar to other commercial units) was attached as a draghead. The auger allowed the dredge to move in a straight line rather than in the normal side-to-side fashion.

During initial dredging, in mid-August 1993, the slip was dredged to -41 feet mlw using the auger head. The slip on either side of the central tube array was then dredged to -44 feet

mlw, leaving 2 to 3 feet of material over the center tubes. Control of the draghead elevation was critical to prevent damage to the fiberglass tubes and cable array located on the bottom of the slip. The 5- to 6-foot tide range at the site required the contractor to continually monitor and correct for elevation changes.

The initial dredging left a 20-foot-wide, 2- to 3-foot-deep layer of silt covering the fiberglass tubes (Figure 2). To remove the remaining silt without damaging the tubes, the contractor constructed a fluidizing pipe that consisted of a 20-inch-diameter horizontal pipe, 24 feet long, with 0.5-inch jets spaced 1 foot apart (Figure 3). This horizontal pipe was lowered from a small A-frame barge. Two high-pressure water pumps (one with a 5-inch-diameter discharge line and the other, a 6-inch-diameter line) supplied water through flexible hoses at 125 psi.

During fluidizing operations (conducted in late August and early September 1993), the horizontal pipe was maneuvered over the row of tubes while the water from the horizontal pipe fluidized the silt surrounding the tubes. Once again, vertical control was crucial.

While the barge was fluidizing the material around the fiberglass tubes, the dredge moved alongside the barge, removing

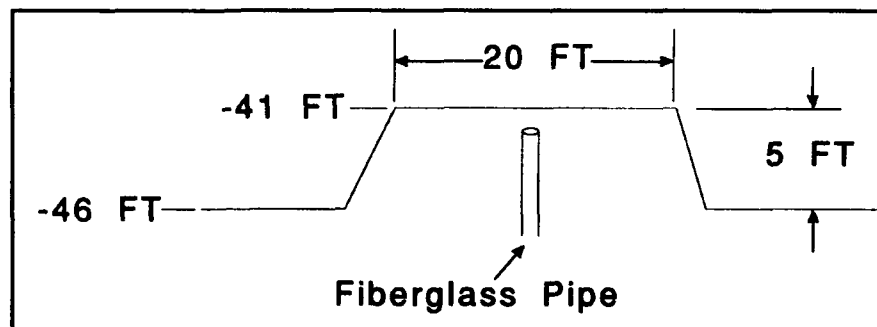


Figure 2. Dredge-cut cross sections prior to fluidizing

the fluidized material. The dredge then moved to the other side of the slip to dredge the remaining material. The operation generated no silt plumes visible from the surface, and divers working within 100 feet of the operation reported little reduction in visibility. Dredged materials were pumped 11,000 feet to an upland disposal area with the dredge *Enterprise* assisting as a booster.

This innovative concept resulted in a successful operation. A flat bottom at -46 feet was produced with the row of undamaged fiberglass tubes extending 3 to 4 feet above the bottom.

For additional information, contact Tom Wright, Wright Dredging Company, at (804) 482-5775, or Alan Garrett, Savannah District, (912) 652-5058.

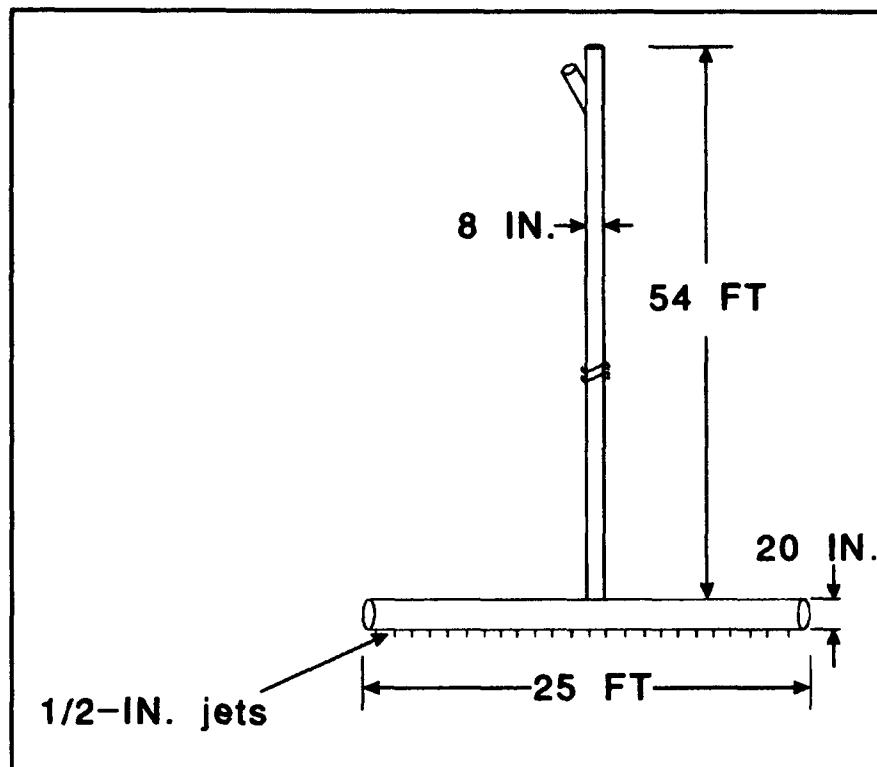


Figure 3. Fluidizing dredge head



James E. Clausner is a hydraulic engineer with the Coastal Engineering Research Center (CERC), Waterways Experiment Station. Jim joined CERC in 1981 after several years at the Naval Civil Engineering Laboratory where he was involved in design and testing of propellant embedment anchors and measuring submerged sediment properties. Jim is responsible for research on sand bypassing projects and equipment. He received his Bachelor of Science and Master of Science degrees in Ocean Engineering from Florida Institute of Technology. Jim is a registered Professional Engineer in the state of Mississippi.

Thomas J. Wright has over 30 years of experience in the dredging industry, having been employed as a field engineer, dredge superintendent, and general superintendent and advancing to the position of executive vice president in 1986. In 1993, Wright Dredging Company of Chesapeake, Virginia, began operations with the purchase of equipment and assets of Atkinson Dredging Company.

Water injection dredging at Bayou Teche, East and West Calumet floodgates

by Gregory L. Williams

In late December 1993, Gulf Coast Trailing (GCT) conducted the first contract water injection dredging (WID) project for the U.S. Army Engineer District, New Orleans, at the East and West Calumet floodgates in Bayou Teche near Morgan City, Louisiana (Figure 1).

Slightly more than 20,000 cubic yards of material was dredged from the floodgate areas and diverted to the neighboring, deeper Wax Lake Outlet (Figure 2). Dredging specifications required a navigable depth of 9.0 feet mean low gulf (mlg) for both floodgate cuts. Material was placed on the side slopes of the Wax Lake Outlet or below the -30-foot contour (and no closer than 110 and 150 feet from the bottom of the West and East floodgate cuts, respectively).

GCT used their dredge BT-208 (Figure 3), which is a non-self-propelled barge designed similarly to HAM Holland's (WID

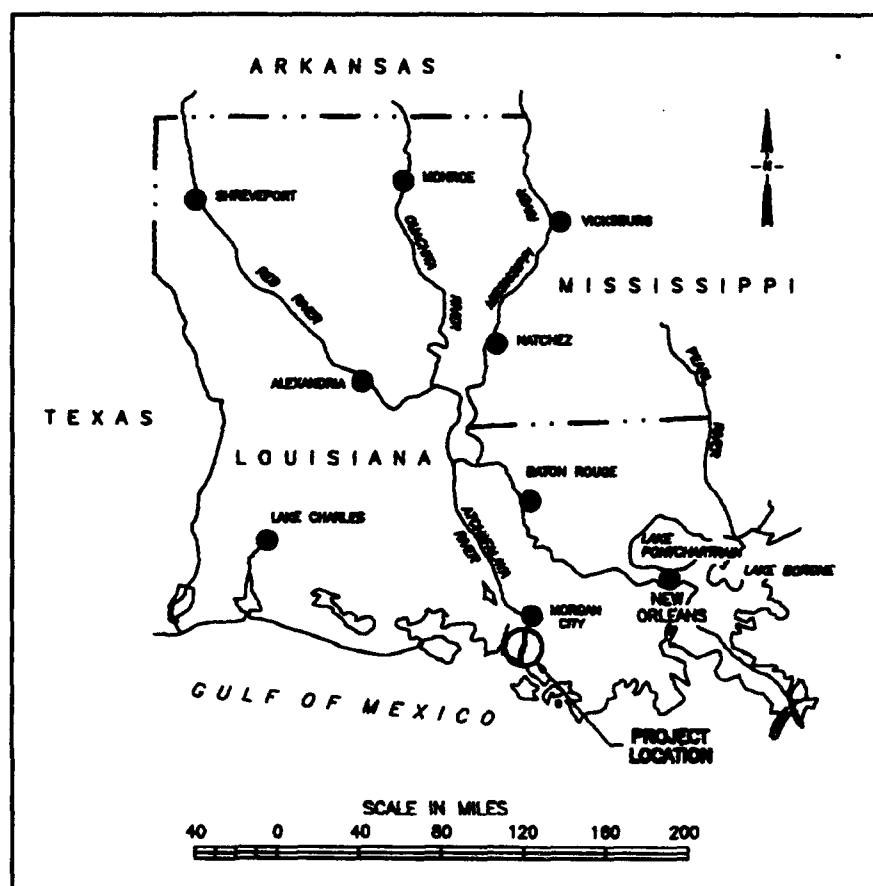


Figure 1. Vicinity map, Calumet floodgates

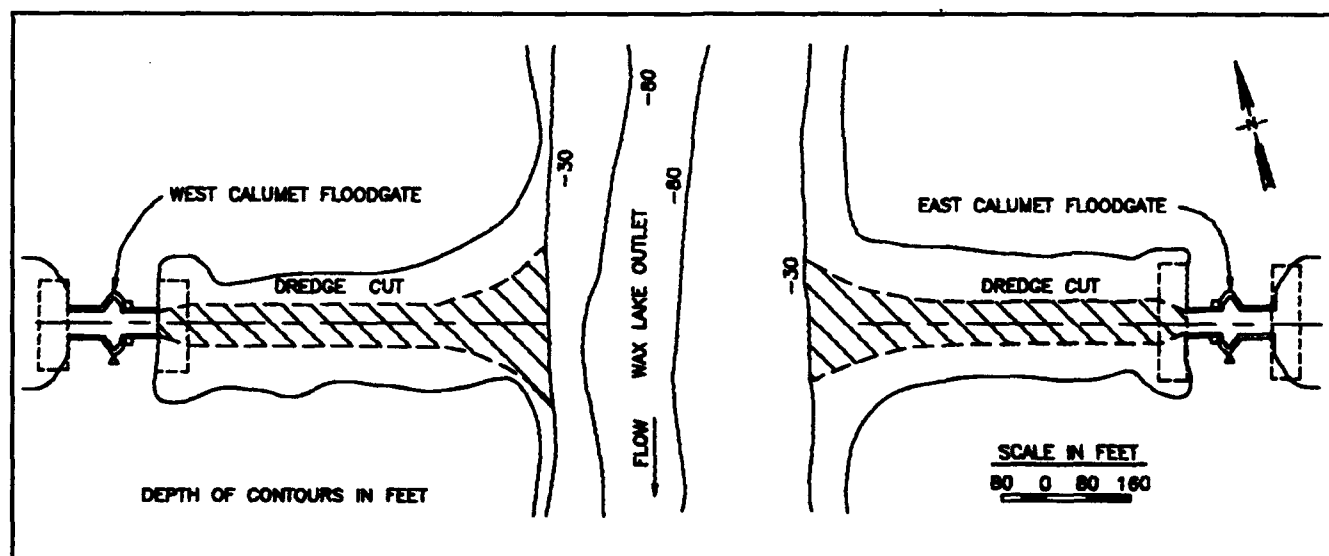


Figure 2. Plan view of floodgates and dredge cut

patent holder) water injection dredge. The 87-foot-long, 28-foot-wide barge draws 3 feet of draft and operates with a crew of three. Propulsion is provided by a push boat. Specific details of the BT-208 dredge are given in *Dredging Research Technical Notes* 3-10 and in *Dredging Research*, Vol DRP-93-3.

The Calumet floodgate cuts are typically dredged with a bucket dredge, requiring 2 to 3 weeks of operating time as well as an increased crew size. For this project, less than 1 month of time elapsed from GCT's bid submission in early December 1993 to project completion on 30 December. Between December 28 and 30, the dredge operation time was 21.5 hours, of which 16.25 hours of actual pumping occurred, resulting in an average production rate of over 1,400 cubic yards/hour.

Background

WID is a relatively new technique of dredging sediment in which shoal material is fluidized, causing it to flow to deeper areas where it will not affect navigation. The WID concept is based on vessel-mounted pumps that inject large volumes of water at low pressures via a horizontal pipe to the substrate. This water causes the sediment to become fluidized, creating a gravity-driven density current that can flow down slopes.

Originally developed and patented in Holland in the mid-1980s, WID potential in the United States has recently begun being developed. In July and August 1992, Gulf Coast Trailing (the U.S. license holder for WID technology) and the U.S. Army Engineer Waterways Experiment Station conducted two WID dem-



Figure 3. Gulf Coast Trailing's WID vessel (BT-208) operating at floodgate

onstrations on the Upper Mississippi River (UMR) with the BT-208 dredge. Prior to the UMR demonstrations, GCT also performed dredging at two locations on the Lower Mississippi River at dock and wharf locations.

The UMR demonstrations were intended to verify the accuracy of contractor predictions of production rate, transport distance and direction, and suspended sediment distribution and also to test the application of the WID technology in conditions found on the UMR (moderate currents, medium-sized substrates, and two types of shoals—crossing and point bars). These demonstrations confirmed that WID is better suited for fine-grained sands and silts, but some success was realized on the UMR at point bars with nearby deeper water.

WID at Calumet floodgates

The Calumet floodgates were ideal locations for application of

WID because of the proximity and access of the deeper Wax Lake Outlet and the small grain-sized material. Both floodgate cuts had design depths of 9.0 feet mlg compared to depths of 80 feet mlg in the adjacent Wax Lake Outlet. Sediment grain size, from four predredging sediment samples (two from each cut), found the material to be a silt ranging between 0.004 and 0.05 mm in diameter.

Predredging surveys were conducted on December 27, 1993, and dredging began at the West floodgate area on the afternoon of December 28, 1993. The dredging procedure consisted of starting from the Wax Lake Outlet and working toward each respective floodgate. Because the WID technique requires an adjacent downward slope for flow of the fluidized sediment, work progressed from the disposal area toward the floodgates. On December 29, dredging moved to the East floodgate area while the West floodgate area was surveyed. Surveying and dredging continued to switch between the

West and East floodgate areas as additional cleanup passes and volume surveys were conducted. Final dredging and surveys were completed on December 30.

GCT reported a total of 23,234 cubic yards of material (14,632 cubic yards from the West floodgate cut and 8,602 cubic yards from the East floodgate cut) with Corps-paid yardage of 21,995 cubic yards. Total cost of the project was \$49,098 (\$15,000 for mobilization/demobilization and \$34,098 for dredging).

Summary

The advantages of WID compared with other traditional types of dredging include lower cost for mobilization/demobilization, quicker response time for project start-up, potentially

lower operating cost, potentially higher production rates (with comparable horsepower), and therefore potentially quicker project completion time.

The WID project at the Calumet floodgates illustrates the practical application of WID technology. In this case, GCT was able to perform the necessary dredging well below the bucket dredge-based government estimate of \$85,000. Significant cost savings

were reflected in the reduced work time, surveying time, and administrative costs.

For additional information on WID experience at the Calumet project, call John Flanagan at (504) 862-1682. For general information on WID, call Jim Clausner at (601) 634-2009 or Clark McNair, Manager, Dredging Research Program, at (601) 634-2070.



Gregory L. Williams is a hydraulic engineer with the Coastal Structures and Evaluation Branch of the Coastal Engineering Research Center. Greg has worked on the interaction of coastal structures and beaches, nearshore berms, wave attenuation over submerged berms, and studies for the Wetlands Research Program. He holds a Bachelor of Science degree in Civil Engineering from North Carolina State University and a Master's degree in Civil (Coastal) Engineering from Old Dominion University. Greg is a registered Professional Engineer in the state of Mississippi.

Calendar of dredging-related events

- | | |
|----------------------|---|
| June 23-24, 1994 | ASTM Symposium on Dredging, Remediation, and Containment of Contaminated Sediments , Montreal, Canada, (215) 299-5400 |
| August 15-19, 1994 | Corps of Engineers 1994 Training Symposium on Surveying, Mapping, Remote Sensing, and Geographic Information Systems , Marriott Hotel, New Orleans, LA, POC: Leonard Halphen, (504) 862-1841 |
| September 7-9, 1994 | Challenges and Opportunities in the Marine Environment—1994 Marine Technology Annual Conference and Exposition , Washington, DC, POC: Beth Cain, (703) 631-6200; (703) 818-9177 FAX |
| November 13-16, 1994 | Dredging '94 , Buena Vista Palace Hotel, Lake Buena Vista, FL, POC: Charles Calhoun, (601) 634-2001 |



Sigsbee Sounding Machine rigged for reeling in, with the strain pulley brought into use (Source: *Deep Sea Sounding and Dredging* by Charles D. Sigsbee, U.S. Coast and Geodetic Survey). Submitted by Norm Scheffner, Coastal Engineering Research Center

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Dredging Research

This bulletin is published in accordance with AR 25-30 as an information dissemination function of the Dredging Research Program of the Corps of Engineers. It is primarily intended to be a forum whereby information on dredging research can be rapidly disseminated to Corps offices, U.S. Government agencies, and the dredging community in general. Results from ongoing research programs will be presented. Special emphasis will be placed on articles relating to the application of research results relating to specific project needs. The contents of this bulletin are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products. Communications are welcomed and should be addressed to Clark McNair, Coastal Engineering Research Center, U.S. Army Engineer Waterways Experiment Station, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199, or call (601) 634-2070.

Robert W. Whalin

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